THE INVENTION CLAIMED IS:

1. A graded index of refraction waveguide formed in an integrated circuit-like structure having a substrate, comprising:

at least one layer of dielectric material positioned above the substrate and defining a trench having side walls, the dielectric material having an index of refraction;

a refractive layer of optically transmissive material adjoining the side walls within the trench and conforming to the side walls, the refractive layer having an index of refraction; and

a core of optically transmissive material adjoining the refractive layer within the trench and conforming to the refractive layer, the core having an index of refraction; and wherein:

the index of refraction of the core is greater than the index of refraction of the refractive layer, and the index of refraction of the refractive layer is greater than the index of refraction of the dielectric material.

2. A waveguide as defined in claim 1 wherein:

the refractive layer surrounds the core except on one side; and

the dielectric material contacts the core on the one side where the refractive layer does not surround the core.

3. A ~~method~~ as defined in claim 2 wherein:

the refractive layer is U-shaped and surrounds the core except on the one side.

4. A waveguide as defined in claim 3 further comprising:

a cap of the refractive material extending across the one side of the core between ends of the U-shaped refractive layer, the cap adjoining and conforming to the core and the refractive layer, the cap having essentially the same index of refraction as the U-shaped refractive layer; and

the cap and the U-shaped refractive layer encircling the core.

5. A waveguide as defined in claim 1 further comprising:

a second refractive layer of optically transmissive material in addition to the refractive layer first aforesaid, the second refractive layer located between the first refractive layer and the core, the second refractive layer adjoining and conforming to the first refractive layer and the core, the second refractive layer having an index of refraction; and wherein:

the index of refraction of the second refractive layer is less than the index of refraction of the core and greater than the index of refraction of the first refractive layer.

6. A waveguide as defined in claim 5 wherein:

the first and second refractive layers surround the core except on one side; and

the dielectric material contacts the core on the one side of the core where the first and second refractive layers do not surround the core.

7. A ~~method~~ waveguide as defined in claim 6 wherein:

the first and second refractive layers are each U-shaped;

the second U-shaped refractive layer surrounds the core except on the one side of the core; and

the first U-shaped refractive layer surrounds the second U-shaped refractive layer except on the one side of the core.

8. A waveguide as defined in claim 7 further comprising:

a cap of the refractive material extending across the one side of the core between ends of one of the first or second U-shaped refractive layers, the cap extending between the core and the dielectric material, the cap having essentially the same index of refraction as the U-shaped refractive layer to which the cap is connected; and wherein:

the cap and the one of the U-shaped refractive layers to which the cap is connected encircle the core.

9. A waveguide as defined in claim 7 further comprising:

a first cap of refractive material extending across the one side of the core between ends of the first U-shaped refractive layer, the cap adjoining and conforming to the core and the refractive layer, the cap having essentially the same index of refraction as the first U-shaped refractive layer; and

a second cap of refractive material extending across the one side of the core between ends of the second U-shaped refractive layer, the second cap having essentially the same index of refraction as the second U-shaped refractive layer;

the first cap adjoins and conforms to the dielectric material and the second cap;

the second cap adjoins and conforms to the core and the first cap;

the first cap and the first U-shaped refractive layer encircles the second cap and the second U-shaped refractive layer; and

the second cap and the second U-shaped refractive layer encircles the core.

10. A waveguide as defined in claim 5 wherein:

the first refractive layer is formed by deposition in a self-aligned manner with the trench;

the second refractive layer is formed by deposition in a self-aligned manner with the first refractive layer; and

the core material is formed by deposition in a self

aligned manner with the second refractive layer.

11. A waveguide as defined in claim 1 wherein:

the refractive layer is formed by deposition in a self aligned manner within the trench.

12. A waveguide as defined in claim 1 wherein:

the refractive layer completely encircles the core.

13. A method of fabricating a graded index of refraction optical waveguide in interlayer dielectric material located above a substrate of an integrated circuit-like structure, comprising the steps of:

forming an elongated trench in the dielectric material;

forming a U-shaped refractive layer of optically transmissive material in the trench;

forming a core of optically transmissive material within the U-shaped refractive layer;

selecting the core material to have a higher index of refraction than the material of the refractive layer; and

selecting the material of the refractive layer to have a higher index of refraction than the dielectric material.

14. A method as defined in claim 13 further comprising the step of:

forming the trench into the dielectric material from an upper exposed surface of the dielectric material.

15. A method as defined in claim 14 further comprising the steps of:

forming the trench with side walls and a bottom surface; and

depositing the material of the refractive layer in a self-aligning manner within the trench on and conforming to the side walls and the bottom surface.

16. A method as defined in claim 15 further comprising the step of:

depositing the core material in a self aligning manner within the trench on and conforming to the refractive layer.

17. A method as defined in claim 16 further comprising the step of:

polishing the materials of the refractive layer and the core to create upper ends of the refractive layer and an upper surface of the core which are substantially planar with respect to an upper surface of the dielectric layer.

18. A method as defined in claim 17 further comprising the steps of:

depositing a cap of refractive material on the upper surface of the core and the upper ends of the refractive layer to encircle the core with the cap and the refractive layer; and

selecting the refractive material of the cap to have

an index of refraction greater than the dielectric material and less than the core.

19. A method as defined in claim 18 further comprising the step of:

selecting the material of cap and the refractive layer to have substantially identical indices of refraction.

20. A method as defined in claim 18 further comprising the steps of:

depositing a layer of refractive material on an upper exposed surface of the dielectric material, on the upper ends of the refractive layer, and on the upper surface of the core; and

etching the layer of deposited refractive material into the cap.

21. A method as defined in claim 14 further comprising the steps of:

forming the trench with side walls and a bottom surface;

depositing the material of the refractive layer first aforesaid in a self aligning manner within the trench on and conforming to the side walls and the bottom surface;

depositing the material of a second refractive layer in a self aligning manner within the trench on and conforming to the first refractive layer;

selecting the material of the second refractive

layer to have an index of refraction greater than the first refractive layer and less than the core; and

depositing the core material in a self aligning manner within the trench on and conforming to the second refractive layer.

22. A method as defined in claim 21 further comprising the step of:

polishing the materials of the first and second refractive layer and the core to create upper ends of the first and second refractive layers and an upper surface of the core which are substantially planar with respect to an upper surface of the dielectric layer.

23. A method as defined in claim 22 further comprising the steps of:

depositing a cap of refractive material on the upper surface of the core and the upper ends of at least one of the first and second refractive layers to encircle the core with the cap and the one refractive layer; and

selecting the refractive material of the cap to have an index of refraction greater than the dielectric material and less than the core.

24. A method as defined in claim 22 further comprising the steps of:

depositing a first cap of refractive material extending between the upper ends of the first refractive

layer;

depositing a second cap of refractive material extending between the upper ends of the second refractive layer;

depositing the second cap on and conforming with the upper surface of the core;

depositing the first cap on and conforming to the second cap;

selecting the refractive material of the second cap to have an index of refraction greater than the first cap and than the core; and

selecting the refractive material of the first cap to have an index of refraction greater than the dielectric material and less than the second cap.

25. A method as defined in claim 24 further comprising the step of:

selecting the refractive material of the first cap to have substantially the same index of refraction as the first refractive layer; and

selecting the refractive material of the second cap to have substantially the same index of refraction as the second refractive layer.

26. A method of fabricating a graded index of refraction optical waveguide in interlayer dielectric material located above a substrate an integrated circuit-like structure,

comprising the steps of:

forming a refractive layer of optically transmissive material having a surrounding a core of optically transmissive material within a trench in the dielectric material; and

selecting the material of the core to have a higher index of refraction than the material of the refractive layer and the material of the refractive layer to have a higher index of refraction than the dielectric material.